Capitol Skies

The Newsletter of the
Madison Astronomical Society

Winter Solstice Issue, December 2024

In this issue:

Madison Astronomical Society to Celebrate 90th Anniversary

MAS's 90th anniversary is coming up next year and the club can't let this milestone pass without making a suitably big fuss. A special event committee has been hard at work for months now putting together a plan. We will be holding a gala event at Promega Corporation's campus in Fitchburg within sight of the club's old Oscar Mayer Observatory, renamed the Bell-Burnell Observatory after Promega renovated it in 2021. The gala will consist of a cocktail hour, a catered meal and a special program to celebrate MAS's shared history with the University of Wisconsin, Bjorksten Labs, and Promega Corporation.

The Gala is for MAS members only and seating will be limited by space considerations. Tickets are $35 per plate and will go on sale at our February meeting

The date is **April 5th, 2025** at 5:00 pm. Please save the date and watch for more information and announcements later this winter.

The current-day Bell-Burnell Observatory at Promega, formerly the Oscar Mayer Observatory of the Madison Astronomical Society.

90th Madison Astronomical Society

1935-2025

From the President's Desk

By Laurence Mohr

Greetings, fellow MAS members. We've had a very rejuvenating year in the Society, and I would like to reflect on how volunteerism has improved our Society during 2024. All of our volunteers should realize the positive impact they're having on the Madison area. No matter how small the contribution, our efforts add up to a positive influence on our community.

I especially enjoyed celebrating this year with many of you at the wonderful picnic we had in September. Thanks to everyone who helped! The picnic was a great time to appreciate the hard work of Dave Leiphart, Chris Zeltner, and their volunteers, who help maintain our dark sky site, Yanna Research Station. I'm also thankful to everyone who helped bring back this newsletter.

I was delighted by how many chose to participate in Moon Over Monona Terrace. I encourage all members to experience this event because it is a great example of MAS' positive effect on our community. There's nothing like seeing the joy on someone's face, no matter how young or old, when they see Saturn or the Moon through a telescope for the first time. Nothing is better than encouraging a stranger to marvel at nature. It doesn't have to be a big event like Moon Over Monona Terrace, with almost 1000 attendees. Just making one person's life a little better, for one moment, is a wonderful thing.

Another of my favorite moments this year was during the Donald Park public star party. A local newspaper reported there would be a presentation about comets at this event, but this was news to me! And I organized the event! In response, I pulled out a presentation I gave to a group of grade school children a few years ago. During my improvised presentation, I asked the audience why astronomers, during Copernicus' time, had trouble accepting his theory that the Earth orbits the Sun. A few adults gave intelligent but incorrect answers. And then a girl of no more than 12-years, raised her hand and gave the correct answer: scientists of the time had no proof the Earth was in motion! It made me so happy to know there was a child out there who was so engaged with science! I was elated to play a small part to encourage her.

It's happy moments like these that should encourage all MAS members to volunteer, no matter how big or small the contribution. Whether it's one or two members hosting a star party for a local organization, helping with repairs at Yanna Research Station, or simply bringing a dish to share at our annual Picnic. The dividend of your efforts is the positive feelings you create and the pleasure of enjoying astronomy with new friends!

Let us look forward to many more such happy moments in 2025!

A Note from the Editor

By Jack Fitzmier

Greetings from the the *Capitol Skies* working group! For several months a group of MAS members have been working to revive the official newsletter of MAS. Members include Jack Fitzmier, Bob Hamers, Alex Langoussis, John Rummel, Alex Samuel, Rob Strabala, and Rick Wayne.

Older versions of *Capitol Skies* were printed and mailed to the membership on a quarterly schedule. This time around, we have elected to go entirely digital. This new version will be distributed to the membership via email as a pdf file, easy to read on phones, tablets, and desktop devices. No printing, no mailing, no budget. We're sticking to the traditional "quarterly" distribution cycle, but have elected to set the pace astronomically — on the solstices and equinoxes: Winter, Spring, Summer, and Fall.

We expect our topics and material to differ slightly from issue to issue. But you can count on seeing reports from our Board Officers, notes about upcoming meetings and star parties, book reviews, outreach reports, tech articles, news about Astronomical League programs, and member spotlights on a regular basis.

Interested in participating? You would be most welcome to join the group! Offer a book review, do some graphic design, write a column about your observing, submit some astronomical humor. For more information contact me at jfitzmier@gmail.com.

MAS Member Spotlight: Danny Glover

By Alex Samuel

Each quarter, *CS* contributor Alex Samuel will interview an MAS member — some new, some veterans — to help us get to know one another better. This quarter Alex interviewed Danny Glover, a relatively new MAS member.

Tell us about yourself? I've been working at Epic since 2005. I'm in Technical Support, my title is Technical Services Manager. I grew up in Minnetonka, Minnesota and moved to Madison to go to the University of Wisconsin where I studied physics and astronomy. I've lived in Madison and Verona ever since. I'm married and have two kids, Owen and Sophie. My wife, Amy, works at Driftless Chocolates in Mount Horeb.

How did you become interested in astronomy? I have always been drawn to science and I've always been interested in the night sky and where we are in the universe.

How long have you been a member of MAS, and what's kept you involved? I've been a member for a little over six months. I think what immediately drew me to MAS was wanting to get to a dark sky site and use a telescope in a site with less light pollution.

Danny Glover

What is your favorite astronomical object or phenomenon? Ever since I've been hanging out at YRS and learning about the night sky from folks like Dave Leiphart and others, I'd say my favorite constellation is Cygnus the swan. Also, my favorite target with binoculars is the Wild Duck Cluster (M11). Beyond that, over the last six months to a year I've been imaging the Lagoon Nebula (M8) and that has been my favorite imaging target.

What equipment do you currently use for observations? I started with an electronic assisted smart telescope, the Dwarf 2. That was my first purchase of a telescope of any type. I also have a pair of Vortex Diamondback Classics 8x42 binoculars that I received as a gift a couple of years ago and I just love them. I also regularly use the club's 8-inch Dobsonian reflector at YRS.

Do you have a favorite telescope or piece of equipment you like to use? What do you enjoy most about it? Binoculars have been my favorite, which was surprising to me. It's amazing how much more you can see out at YRS!

Have you had any memorable observing experiences or "wow" moments when stargazing? I was hanging out in the backyard and taking a look at the sky and the aurora borealis was really ramping up here in Verona and I went and woke up my son and we got to watch it together, which was just a really, really cool experience.

What was the most challenging or rewarding observation you've done? An unexpected highlight of my recent trip to the Umbria region of Italy was nine nights of clear dark skies. I brought my binoculars and my Dwarf 2 telescope. I found so many objects that I hadn't seen before and I had so much time where I didn't have to worry about work or anything else and I was focused and had all night to just stare at the sky from this mountaintop in Italy. So I'll never forget it. That was pretty memorable.

Are there any specific projects or goals you have in the world of astronomy that you're currently working on or that you would like to achieve? My current goal is to hit all of the Messier objects visually. I'm probably 2/3 of the way through. I've been using mostly binoculars, but some of them are faint enough, small enough that the Dobsonian has been key to getting some of them as well. I'm doing pretty well and it's been a really fun way to gain an understanding of the night sky and learning how to star hop and find objects.

Outside of astronomy, what are your interests? I'm in a local band, Danny Glover and the Lethal Weapons. I play guitar and I'm the lead singer. We play around Verona a few times a year, we play a lot of covers, mostly Pink Floyd and we play *Dark Side of the Moon* in its entirety, but we have a bunch of original songs as well.

Do you have any advice for new members of MAS? Get to YRS, especially for a star party, but also anytime you can. Everyone I've met out there has been so generous with their knowledge and their time and their equipment and they are willing to share what they're seeing and what they're excited about. It's been amazing. I recommend everybody just take the jump and get out there and you'll have a lot of fun and meet folks.

Astronomical League Observing Program

By Jack Fitzmier

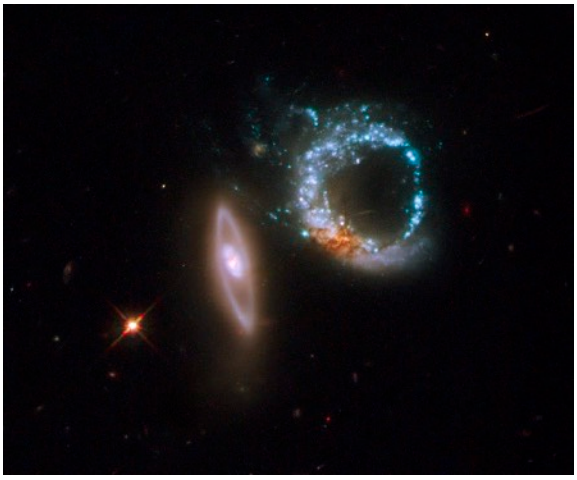
This quarter we feature the AL's Arp Peculiar Galaxy (Northern) Observing Program. Halton Arp (1927 – 2013) was an American astronomer best known for his *Atlas of Peculiar Galaxies,* which was published in 1966. Though he made many contributions to astronomy, he was particularly interested in how galaxies change over time. His *Atlas* cataloged some 338 "peculiar" galaxies visible from the northern hemisphere. Some were oddly shaped, some were colliding with other galaxies, others looked unusual for one reason or another.

But peculiar is the correct description! Check out the Hubble photos on this page, clockwise from the top. Arp 244 (also known as the Antennae Galaxies, the Ringtail Galaxies, NGC 4038, and Caldwell 60) is the result of two colliding galaxies that form a single magnitude 10 object. Arp 147 (also known as IC 298) is also unusual. The two galaxies heading toward one another remind me of two colliding Ring Nebulae! Arp 142 is a triplet: NGC 2936, NGC 2937, and PGC 1237172. The middle object is aptly known as the Porpoise Galaxy. Arp 81 (NGC 6621 at the center and NGC 6222 at the left) reminds me of a cocoon.

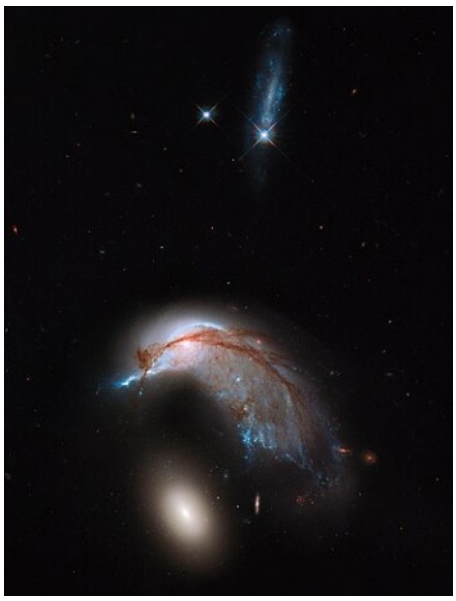
The Arp Observing programs require you to observe 100 objects from the Arp Catalog, visually or by imaging, prepare a logbook of your observations, and submit it to the Program Coordinator. If the Coordinator deems it satisfactory, you will be awarded a Certificate of Accomplishment and a decorative lapel pin. Detailed information can be found on the AL site.

Interested in Professor Arp? Objects in the Arp Catalogs? Google and Wikipedia are a good place to start. If you are interested in exploring the possibility of starting an Arp Observing Program or another AL Program, feel free to contact Jack Fitzmier, MAS's AL Coordinator, for more information. You can reach him at jfitzmier@gmail.com.

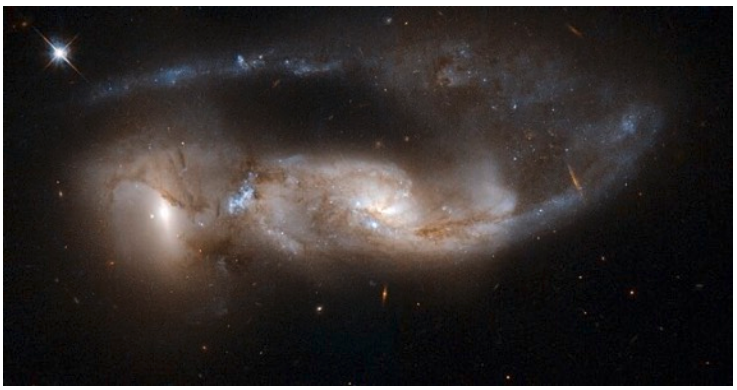
Apr 244



Arp 147



Arp 142



Arp 81

The Visual Observer: Seeing Clouds

by Alex Langoussis FRAS

Our galaxy is filled with clouds of gas and dust. These clouds provide us with some of the most beautiful visual sights in the nighttime sky. But to be visible to our eyes, they need starlight to be seen. *Nebulae* (a fancy word for clouds) are normally categorized by the method by which they are made visible.

Emission nebulae can be seen because they glow. The gas is ionized by the UV radiation from nearby hot (O and B spectral type) stars, and then emits light when electrons are reabsorbed. The Orion Nebula is the best example of an emission nebula visible in winter.

Reflection nebulae are made visible by relatively cooler stars. These stars don't produce enough UV light to make gases glow, but the starlight reflects off of the dust particles in the clouds. They appear bluish because dust scatters the shorter-wavelength blue light more than red. (Think blue sky.) The nebulosity you see in the Pleiades is a good example.

Dark nebulae can only be seen visually if there is a bright nebula or a multitude of stars behind them, but can really add pizzazz to your view. Good examples would be the dark nebulae associated with the Orion or Rosette Nebulas, or the 'rifts' in the naked eye Milky Way.

The use of *nebula filters* (not light pollution filters) can greatly enhance your view of these nebulae, but keep in mind that *the filters only help with the emission nebulae*. Put a nebula filter in the telescope when viewing a reflection nebula, and the nebula may simply disappear! Nebula filters also will not help with galaxies (except their HII regions), stars, or clusters.

But which filters? There is no one best, because it all depends on the target you're viewing. In the visible-light range, emission nebulae emit light in Hydrogen-beta (486nm) and/or Oxygen-III (496/501nm). Most emission nebulae emit both, so a *narrow-band* (UHC) type filter, which enhances both H-beta and O-III emissions, will help with the most objects, such as the Orion or Lagoon Nebulas. Other objects show better with one of the *line-band* filters. A line-band filter will transmit either H-beta or O-III, but not both. The O-III is excellent for most planetary nebulae, as well as supernova remnants such as the Crab or Veil Nebulas. The H-beta filter is excellent for bringing out IC434, the bright nebula that is the backdrop for the Horsehead. The California Nebula and Barnard's Loop are two other winter targets that can benefit from it.

From a dark site, try observing Barnard's Loop naked eye using the H-beta, holding the filter up to your eye.

Of course, there are many more celestial clouds to be seen than the few mentioned here. If you add these three filters (in order of most useful, UHC, O-III, and H-beta) to your eyepiece case, you will greatly enhance your enjoyment of the nighttime sky. When you view one of our cosmic clouds, try out each filter, and see which one you like best!

M20, the Trifid Nebula, showing an emission nebula in the center, a reflection nebula above it, and strands of dark nebulae interspersed throughout. Credit: NOAO

Tech Corner: An Introduction to Astrophotography Image Calibration

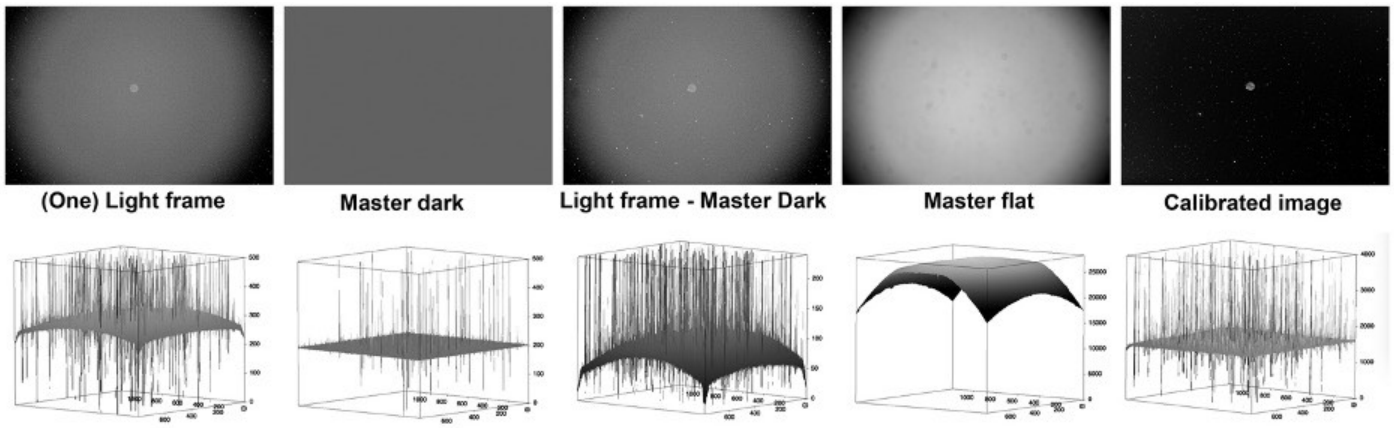
By Bob Hamers

To get good astrophotos, *calibration* of the images is one of the most important steps. Image calibration involves making two types of corrections to raw image data. In the first we correct for sensor imperfections such as shifts from zero. In the second we correct for optical system imperfections such as dust, scratches, and vignetting and for remaining pixel-by-pixel differences in sensor sensitivity (gain).

The raw images of astronomical objects are referred to as "Light frames" or simply as "Lights". In addition to the signal from our astro-object, Lights also contain an offset ("bias") and a time-dependent dark current contribution. To compensate for these, we create a set of "Darks." These are images with no light hitting the camera (say, by putting the lens cap on) that are averaged together into a "Master Dark".

See the grid of figures below. The first column shows a Light frame and its 3D view. Notice that the Master Dark (in the second column) appears quite uniform. But its corresponding 3D view shows that the Dark value is also shifted away from zero (it has a "bias") and shows upward and downward spikes from "hot" and "cold" pixels. However, if our Lights and Darks were taken under identical conditions, subtracting the Master Dark from the Light frame yields an image that more accurately represents the light that struck the camera sensor (see the middle column). In its 3D view, you can see values now extending from 0 up to some positive value.

Abell 33, imaged using a narrowband oxygen O(iii) filter, which corresponds to a wavelength of light (501 nanometers) that is teal in color. Repeating this process with a narrowband H-alpha filter (656 nm, which is deep red) and then with additional images using Red, Green, and Blue filters gives a final, cropped image shown here.



The figure above shows a 256-second exposure of Abell 33, a small planetary nebula, as it goes through calibration, both in the conventional "stretched" grayscale view (upper row) and also as a 3D representation of the raw data (without stretching, lower row). In the 3D view, the sharp lines going all the way up and down come from the bright stars, along with individual "hot" pixels and "cold" pixels. These are difficult to see in the top-view image because there are relatively few of them.

Dealing with the optical train and variations in sensor sensitivity involves taking “Flat” frames. By illuminating the front of our scope with a uniform-intensity light source, one gets images that reveal the optical transmission through the scope (highest in the center, lower at the edges) and any pixel-by-pixel variations in the sensitivity (gain) of the sensor. As in the case of our Darks, we create a Master Flat (column 4). We now divide our Dark-corrected Light frame by the Master Flat to get a calibrated image frame. An equation would look like this:

$$Calibrated\,Frame = \frac{Uncalibrated\,Frame - Master\,Dark}{Master\,Flat}$$

Once all the frames from a viewing session are calibrated, they can be aligned and stacked together into a high-quality image (rightmost column).

There are a few subtleties involved in calibration not discussed above. A small “pedestal” is sometimes added into images so that “cold” pixels and images produced by subtraction (such as our Dark-subtracted Lights) are above zero, even with noise present. In addition, the “Flats” should also be corrected with their own Master Dark, taken under the same conditions as the Flats. The effort associated with Darks can be greatly minimized through the use of short-exposure “bias” frames. A full explanation is too long for this newsletter, but if you are interested in understanding the details of “dark scaling” and the use of bias frames, I’ve created a more detailed writeup that I’m happy to send to anyone interested. Simply send me an email to rjhamers@gmail.com and I’ll forward it on.

MAS Outreach Report

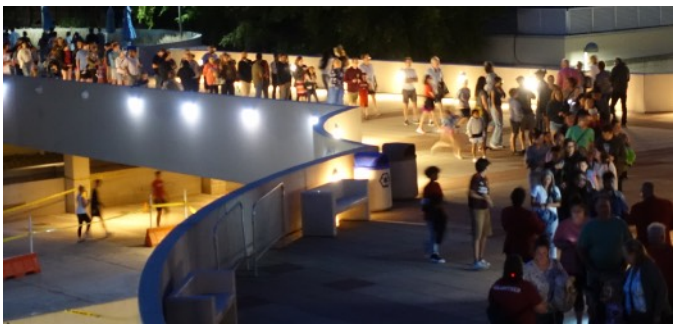
By Rick Wayne

Last November, Society Secretary Dan Hyslop asked for volunteers to staff an MAS table at the Yerkes Observatory's annual glass festival. He noted that there had been "a surge in requests" to the Society for public events: speakers, star parties, and the like. He proposed that we have a group at the ready for those, and thus was born the outreach committee.

Apparently the word got out that the Society had an events team, and that we didn't suck. The surge in requests became a stream, and since then volunteers have staffed a wide variety of outreach happenings. Of course, the all-hands-on-deck effort for Moon Over Monona Terrace is still our flagship community showpiece, with hundreds of Madisonians lining up to look through a wide variety of scopes, listen to talks, and watch live displays. If you haven't participated, you really owe it to yourself to come whoop it up. It's not just service, it's a ton of fun. Where else can you find hundreds of people who want nothing more than to admire your instruments, exclaim over the view through them, and best of all, listen raptly as you talk about astronomy? Mainline that stuff straight into MY veins, please!

But in some ways, the smaller events are even better. Sometimes it's staffing a table, and you get to chat with passers-by and show off your cool tech when it's light enough to see it. We did that for Yerkes, and a big Civil Air Patrol shindig in April. We talked to a lot of young cadets who couldn't resist the gadgetry we had laid out. We've done star parties at county parks and at the Treinen Corn Maze farm. We helped a Girl Scout troop bag their Space Science badge, and helped put on a "Night Sky Exploration Program" for Junior Rangers with Madison City Parks. And there have probably been a few that your correspondent is missing, here.

If you're in MAS to learn, there is no better way than explaining to other people. (No, seriously.) If you're in it to support astronomy generally, well, kindle that love in the public, could you please? And if your significant other observes that you just Can't. Stop. Talking. About. Astronomy…wow, do we have a sweet gig for you! Contact Dan Hyslop (about joining the outreach team.



Moon Over Monona 2024

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The Madison Astronomical Society was founded in 1935 as a "lay group with the common desire to know more about the mystery of the universe."

No special preparation is needed to join the ranks of the MAS. The only requirement is a genuine interest in any phase of astronomical observation or study. Our members are amateurs with skill levels from novice to experienced observers.

Madison Astronomical Society members are active in sharing the pleasures of astronomy with the public, acting as a resource for students and teachers, and exchanging information at Society meetings which occur monthly. The Society continues to pursue its original goal to "promote the science of astronomy and to educate the public in the wonders of the universe." For more information about the Society, please contact one of the officers (listed at left) or visit us on the web at madisonastro.org.

MAS Frequently Asked Questions

Where does MAS meet?
We meet at UW Space Place, located in the Villager Mall (right behind the Goodman Library), a block north of the Beltline Highway at 2300 S. Park St., Madison. Space Place is located at the lower level of the Atrium. Space Place has a lovely classroom setting for our meetings as well as a museum with exhibits highlighting the UW's role in space science and astronomy.

When does MAS meet?
Most months we meet on the 2nd Friday of the month.

What happens at MAS meetings?
MAS meetings follow a pretty predictable routine. Most meetings start with a 'newcomers orientation' at 6:45, a social time for meet and greet from 7-7:15, announcements and welcome visitors at 7:15, and the main presentation at 7:30.

What are the presentations like?
Our presentations are of two main types: talks by our own members about the stuff we do (observing, photography, gear, etc.) and presentations by astronomers and other professionals about their research.

Do I need any special knowledge to be a member?
Not at all. Our members come from all walks of life with education levels from "barely made it through algebra" to advanced degrees. All you need is a curiosity about the universe and a desire to learn.

Upcoming MAS Programs

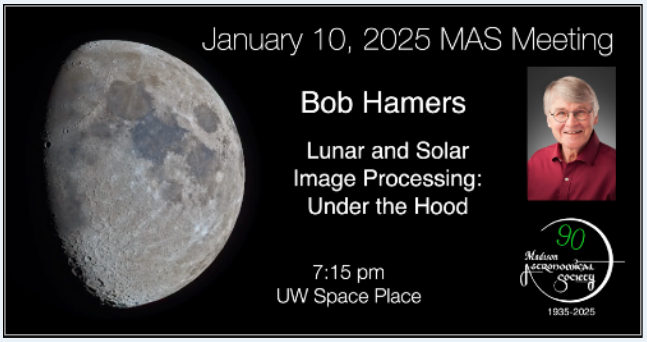
Brian Champion on solar photography—February 14, 2025

Carrie Eaton, curator of the UW Geology Museum, will give a talk on meteorites—March 14, 2025 (The Geology Museum has an extensive collection.)

Happy Birthday! MAS celebrates its 90th year of continuous operation as a club —April 5, 2025

Terry Genske will talk about imaging some of the most bizarre and enigmatic deep sky objects, like quasars, blazers, and more— April 11, 2025

January 2025 Meeting



About Bob Hamers: Bob is a UW-Madison Professor of Chemistry and MAS member. His UW research centers on chemical and structural analysis of solids and their surfaces. Bob's astrophotography interests include solar, lunar, and DSO imaging.

Bob's description: Many commercial programs do a good job processing most images. To get the very best result, it can be helpful to use additional tools to analyze, process, and visualize the process. In this talk, I'll discuss some of the challenges of solar and lunar image processing and demonstrate some freeware tools that can be used to help get the most out of your data. I'll walk through the processing of high-resolution, full-disc RGB imaging of the Moon and continuum imaging of the Sun, and I'll briefly introduce the freeware tools ImageJ and Python.